



3D PRINTED AFFORDABLE HOUSING FOR CLEVELAND

May 13, 2024

About Lutheran Metropolitan Ministry (LMM)

History & Mission:

Founded in 1969 as a faith-based response to racial unrest on the East Side of Cleveland, the mission of **LMM** is to **challenge systemic injustices faced by those who are oppressed, forgotten, and hurting** by **providing responsive solutions, advocacy, and hope.**

About Lutheran Metropolitan Ministry

LMM is a 55-year-old non-profit organization that was **founded in Cleveland**, is **head-quartered in Cleveland**, and is **committed to** providing innovative responses to basic needs and advocacy in and around **Cleveland**, and beyond.

LMM seeks that people facing adversity be empowered, valued, and healed by an unwavering commitment to addressing chronic needs, enabling people to self-sufficiency, and advocating for systems change.

We seek to change the conversation about justice **from** one of **limitations**, **to** one of **possibilities**.

About Lutheran Metropolitan Ministry

- **Programs & Services**
 - Housing & Shelter
 - Workforce Development
 - Youth Resiliency
 - Adult Guardianship
- **H&S Programming**
 - Men's Shelter on Lakeside (since 2005)
 - Family Overflow Shelter
- **Experience with Affordable Housing** (since 2016)
 - Coventry House 1 & 2 (singles)
 - Breaking New Ground (families)
 - Total Housing Units:
 - 20 units occupied by tenants
 - 11 units in development



LMM'S VISION FOR AFFORDABLE HOUSING

LMM seeks to develop affordable and innovative housing with The City of Cleveland and collaborating partners to bring together cutting-edge technology to **end homelessness, provide affordable housing, stabilize neighborhoods, and create workforce development opportunities; and serve as a model locally & nationally.**

CUTTING EDGE
TECHNOLOGY



COMMITTED
PARTNERS



INNOVATIVE AFFORDABLE
HOUSING SOLUTIONS



Who will benefit from housing innovation?

- The need for affordable housing is urgent and expanding
- Recent Zillow study revealed Cleveland has the 5th largest racial and ethnic disparity in rent burden among Top 50 metro areas in U.S.
- Significant economic and community impact
- Older adults are increasing overall in Cleveland
- Unfortunately, senior population is also increasing at Men's Shelter on Lakeside
- Source: <https://zillow.mediaroom.com/2024-04-29-BIPOC-renters-hit-hardest-by-high-rent-costs>



Why 3D printed houses?

- Increase affordable housing stock - costs significantly less than traditional new builds
- Timeliness – can build units in a matter of weeks
- Cleveland as a national leader, creator, and innovator in this space
- Address homelessness and households with low/mod income
- Creates workforce development opportunities with training in 3D printing (multi skill levels), job placement



Why 3D printed houses?

- Community stabilization - building on vacant parcels (thousands in County and City landbanks currently)
- Environmental sustainability - up to 90% reduction in construction waste
- Healthy and safe homes - no lead hazards, universal design

Timeline & Costs

Pilot Plan

- Contract with City of Cleveland: \$500,000
 - \$150k due diligence process
 - Six months
 - \$350k pilot 2 homes
 - Up to 18 months

Continuation Plan:

- Identify partners and collaborators for replication
- Create a replication plan
- Develop budget for replication plan/full demonstration
- Secure 3D equipment
- Recruit & train workforce
- Print homes

COST PER BUILD

- **Range between \$90 - \$180 per square foot**
 - 3D house in Austin, TX
 - Icon Build
 - Complete construction was \$140K; 1,000 SF, 2 bedrooms 1½ half bath
- **Cost Factors (to be explored during due diligence)**
 - Location
 - Proximity of concrete plant to site
 - Site condition challenges
 - Construction material cost
 - Permitting process with City Officials
 - Weather
 - Trained workforce/labor
 - Utilities

Construction Process

- **Primary structure(s) is printed with a 3D printer machine**
 - Customized concrete mix that extrudes through nozzle of printer
 - Lumber used as needed, mainly for roofing
- **Use digital drawing / model to create a physical structure**
- **Gradually prints the material in layers**
- **Installation of components added after printing process**
 - Roofing
 - Windows & Doors
 - HVAC
 - Plumbing
 - Electrical & Utilities
 - Location of utilities are designed/coordinated during printing
 - Approximately 70% can be installed during printing
 - For expansion / addition, no different than traditional house: Wall(s) identified for demo and new walls printed; floorings, finishes, etc. installed.

Construction Process – The Weather Factor

- To mitigate weather impact, walls can be printed in sections within controlled environment
- Once walls are cured, they are delivered to site and installed.
- Estimate installation involves telehandler forklift & 2-3 people.
- Concrete has a special mix with components for weather resistance.
- Studies indicate 3D printed houses longevity can be 100+ years, if well maintained (www.sq4d.com)

3D Printing Developers

- Pantheon - Youngstown, OH
<https://pantheoninnovativebuilders.com/>
- Sustainable Concrete Innovations - Columbus, OH
<https://www.live3dhomes.com/>
- Vitruvian - Columbus, OH <https://www.vitruvian3dprinting.com/>
- Robotic Citizen - Detroit, MI <https://www.citizenrobotics.org/>
- Black Buffalo - Strasburg, PA <https://bb3d.io/>
- Apis Cor - Melbourne, FL <https://www.apis-cor.com/>
- Icon Build - Austin, TX <https://www.iconbuild.com/>
- RIC Technology - Torrance, CA
<https://www.rictechnology.com/contact-us>

OH Companies



Pantheon Innovative Builders



Sustainable Concrete Solutions

THANKS!



Any questions?

3D Printed House Rendering by I You Design